

Powdery mildew of ornamental species caused by *Oidiopsis haplophylli* in BrazilAilton Reis^{1,3}; Leonardo Silva Boiteux^{1,3} & Milton Luiz Paz-Lima²

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1309

ABSTRACT

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Oidiopsis haplophylli (syn. *Oidiopsis sicula*) was identified as the causal agent of powdery mildew diseases occurring on five ornamental species in Brazil. This disease was observed in plastic house-grown lisianthus (*Eustoma grandiflorum*: Gentianaceae), in nasturtium (*Tropaeolum majus*: Tropaeolaceae) cultivated under open field conditions and in greenhouse-grown calla lily (*Zantedeschia aethiopica*: Araceae), impatiens (*Impatiens balsamina*: Balsaminaceae) and balloon plant (*Asclepias physocarpa*: Asclepiadaceae). Typical disease symptoms consisted of chlorotic areas on the upper leaf surface corresponding to a fungal colony in the abaxial surface. With the disease progression, these chlorotic areas eventually turned to necrotic (brown) lesions. Fungi morphology on all hosts was similar to that described for the imperfect stage of

Leveillula taurica (*O. haplophylli*). The Koch's postulates were fulfilled by inoculating symptom-free plants via leaf-to-leaf contact with fungal colonies. Additional inoculations using an isolate of *O. haplophylli* from sweet pepper (*Capsicum annuum*) demonstrated that it is pathogenic to all five species belonging to distinct botanical families, indicating lack of host specialization. This is the first formal report of a powdery mildew disease on lisianthus, calla lily, impatiens and nasturtium in Brazil. It is, to our knowledge, the first report of *O. haplophylli* infecting *A. physocarpa*, extending the host range of this atypical powdery mildew-inducing fungus. This disease might become important on these ornamental crops especially in protected cultivation and also under field conditions in hot and dry areas of Brazil.

Additional Keywords: *etiology*, *Leveillula taurica*, *lisianthus*, *calla lily*, *nasturtium*, *impatiens*, *Asclepias physocarpa*.

RESUMO

Reis, A.; Boiteux, L. S. & Paz-Lima, M. L. Oídio em plantas ornamentais, causado por *Oidiopsis haplophylli*, no Brasil. *Summa Phytopathologica*, v.33, n.4, p.405-408, 2007.

O fungo *Oidiopsis haplophylli* (= *O. sicula*) foi identificado como sendo o agente causal de uma nova doença do tipo oídio em beijo-de-frade (*Impatiens balsamina*: Balsaminaceae), capuchinha (*Tropaeolum majus*: Tropaeolaceae), copo-de-leite (*Zantedeschia aethiopica*: Araceae), lisianthus (*Eustoma grandiflorum*: Gentianaceae) e flor-borboleta (*Asclepias physocarpa*: Asclepiadaceae) em Brasília-DF, Brasil. Esta doença foi observada em condições de casa de vegetação em beijo-de-frade, copo-de-leite, lisianthus e flor-borboleta e em condições de campo na capuchinha. O sintoma típico é o aparecimento de uma área clorótica na superfície superior da lâmina foliar que corresponde a uma colônia fúngica na superfície inferior. Com o progresso da doença, estas lesões tornavam-se necróticas e

eventualmente coalesciam. As características morfológicas, observadas em microscopia de luz, corresponderam àquelas descritas para a fase imperfeita do fungo *Leveillula taurica* (*O. haplophylli*). Os testes de patogenicidade foram completados via inoculação por contato entre folhas sadias e folhas apresentado colônias do fungo. Um isolado de pimentão foi também patogênico a estas cinco espécies ornamentais (pertencentes a diferentes famílias botânicas) confirmando a ausência de especialização por hospedeiro deste fungo. Este é o primeiro registro deste patógeno nestas espécies ornamentais no Brasil e, provavelmente, o primeiro relato de flor-borboleta como hospedeira. Este oídio pode se tornar importante para o cultivo destas espécies em cultivo protegido ou condições de clima quente e seco.

Palavras-chave adicionais: *etiologia*, *Leveillula taurica*, *lisianthus*, *copo-de-leite*, *capuchinha*, *impatiens*, *Asclepias physocarpa*.

Ornamental pot plants and flowers (for both exporting and internal markets) are among the fastest growing agribusiness segments in Brazil. In the first half of 2005, total exports of this sector reached US\$ 14 millions with an expansion of 19.5% compared to the same period of the year 2004. In Brazil, due to the large number of microclimate conditions, many ornamental plant species can be cultivated throughout the year. In addition, many ornamental plants are now being cultivated under greenhouse and plastic house. Cultivation under open field conditions using drip-

irrigation is also increasing in the Northeast and Central Brazil, especially during the hot, dry season. In these circumstances, plant pathogens that are dependent upon high humidity and free water for infection and/or dissemination become minor problems. On the other hand, this novel cultivation system has favored a whole new set of pathogens that were not formerly reported as major diseases in the country. One group of pathogens that became prevalent under these conditions comprises fungi belonging to the Erysiphaceae, which are able to induce powdery mildew diseases

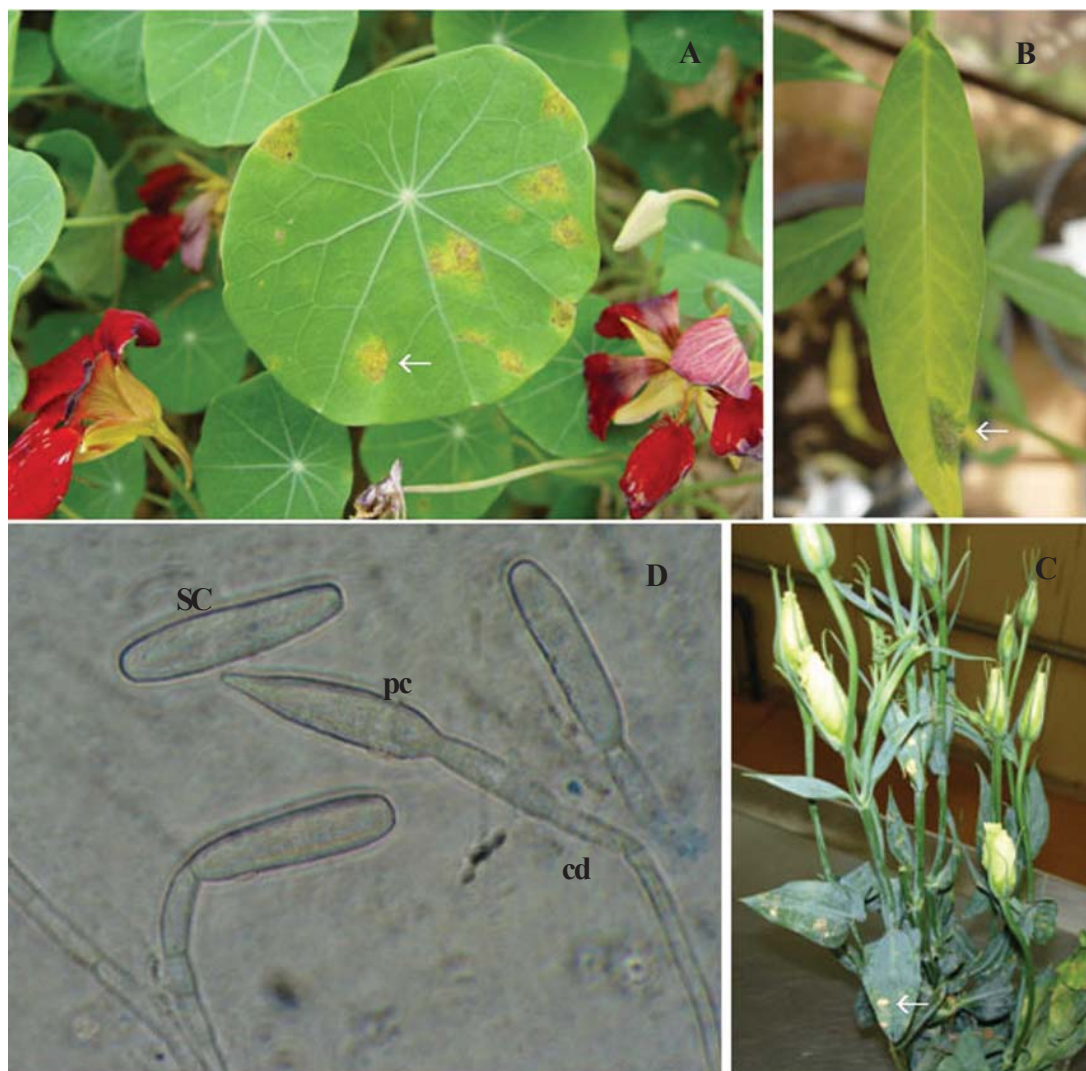


Figure 1. Symptoms of powdery mildew, caused by *Oidiopsis haplophylli*, in ornamental species: A = nasturtium, B = balloon plant, C = lisianthus and D = structures of the imperfect state of *O. haplophylli* (pc = primary conidium, sc = secondary conidium and cd = conidiophores). Arrows are indicating necrotic lesions induced by the fungus.

in many plant species. *Oidiopsis haplophylli* Rulamort (= *Oidiopsis sicula* Scalia or *Oidiopsis taurica* Salmon) is one of the most economically important fungal species reported infecting a wide range of vegetables and ornamental plants throughout the world (4, 9). In Brazil, powdery mildew outbreaks caused by *O. haplophylli* have been reported on processing tomatoes, fresh-market tomatoes and sweet peppers in several Brazilian States (3, 8, 11, 12, 13). The host range of *O. haplophylli* is expanding in the country with several new reports on distinct vegetable and ornamental hosts (10, 11, 13). *Oidiopsis haplophylli* has not been reported as seed-transmissible, therefore, it is more likely that this fungus was introduced in Brazil via infected ornamental pot plants (11).

In recent years, novel powdery mildew diseases have been observed affecting a range of ornamental species in distinct growing regions in Brasília (Federal District, Brazil). Powdery mildew diseases were noticed on impatiens or touch-me-not (*Impatiens balsamina* L.: Balsaminaceae), balloonplant [*Asclepias physocarpa* (E. Mey.) Schlechter: Asclepiadaceae] and white arum lily or calla lily [*Zantedeschia aethiopica* (L.) Spreng.: Araceae] cultivated under glasshouse conditions. Plastic house Lisianthus [*Eustoma grandiflorum* (Raf.) (Shinners): Gentianaceae] in São Sebastião (Federal District) and open field-grown nasturtium (*Tropaeolum majus* L.: Tropaeolaceae) in Ponte Alta (Federal District) were

also found to be affected by a new powdery mildew disease. In the present work, we report that all diseases were caused by a single agent, *O. haplophylli*.

Leaf samples of impatiens, balloon plant and calla lily collected in a glasshouse in Brasília (Federal District) showed disease symptoms characterized by yellow spots on upper surface of leaves corresponding to the establishment of a fungal colony in the abaxial surface. As disease progressed the yellow spots developed a light brown color. Similar symptoms were also observed in leaf samples of field-grown nasturtium in Gama (Federal District). Lisianthus plants collected in São Sebastião (Federal District) displayed similar symptoms (Figure 1A-C).

The affected areas were visualized under stereomicroscope, symptomatic leaf sections were removed and the fungal structures were visualized in microscope slides prepared by mounting thin host tissue slices in lactophenol. Measurements of length and width were done using 50 primary and 50 secondary conidia that were collected from each host described in the present investigation. Other morphological aspects of the fungal structures associated with the imperfect stages of powdery mildew fungi (2, 4, 9) were observed including color of conidia, vacuoles and type of germination tube. Pathogenicity tests were performed by inoculating symptom-free plants via leaf-to-leaf contact with fungal colonies. A group of test plants was separately inoculated with each of the

Table 1. Length and diameter of primary and secondary conidia of *Oidiopsis haplophylli* obtained from impatiens (*Impatiens balsamina*: Balsaminaceae), nasturtium (*Tropaeolum majus*: Tropaeolaceae) calla lily (*Zantedeschia aethiopica*: Araceae), lisianthus (*Eustoma grandiflorum*: Gentianaceae), balloonplant (*Asclepias physocarpa*: Asclepiadaceae), and sweet pepper (*Capsicum annuum*).

Host	Primary Conidia*		Secondary conidia*	
	Range	Average	Range	Average
Impatiens	57.6-68.2 x 16.3-21.1	62.8 x 19.0	52.8-70.1 x 11.5-21.1	59.6 x 17.1
Nasturtium	49.0-71.0 x 15.0-18.0	60.0 x 16.5	44.0-64.0 x 11.0-23.0	56.6 x 16.2
Calla lily	51.7-73.2 x 14.2-18.9	58.5 x 15.4	55.3-69.0 x 15.6-17.9	56.8 x 15.4
Lisianthus	54.2-71.4 x 13.6-18.5	60.1 x 15.7	54.5-70.6 x 13.8-18.7	58.9 x 15.2
Balloon plant	51.2-71.1 x 14.3-18.3	58.2 x 15.3	56.0-68.8 x 14.7-17.8	56.5 x 14.8
Sweet pepper	59.6-74.4 x 14.3-19.1	62.4 x 15.2	57.2-71.1 x 13.7-18.9	62.1 x 14.9

*Length and diameter, measured in μm .

**Standard host plant.

five isolates obtained from each host and also with one isolate from pepper.

Observations on the light microscope revealed that mycelium is predominantly endophytic with the presence of conidiophores emerging through leaf stomata. Some conidiophores were divided into two to three branches. Ellipsoidal, light pale conidiospores (conidia) were borne predominantly single and terminally on the conidiogenic cell. The main light microscopy and host range diagnostic characters of *O. haplophylli* were in complete agreement with that described by Braun (4) and Palti (9): large primary conidia with lanceolate shape and secondary conidia with a cylindrical shape (Figure 1D), presence of endophytic mycelium and not-lobed appressorium. The presence of the sexual stage (*Leveillula taurica*) was not observed in the leaf samples of any host plant throughout this investigation.

The length and diameter measurements taken from primary and secondary conidia of the impatiens, balloon plant, calla lily and nasturtium isolates as well as the standard *O. haplophylli* isolate from sweet pepper (*Capsicum annuum* L.) cv. Ikeda are shown in Table 1. All morphometrical characteristics (including their ranges) are in agreement with the ones reported in the literature for *O. haplophylli* (2, 4, 9).

Koch's postulates were fulfilled for all five ornamental species. The host range studies indicated that *O. haplophylli* isolate from sweet pepper is also virulent on these five ornamental plants, belonging to five distinct botanical families. Therefore, there was no clear indication of host specialization of these isolates. This suggests that sweet pepper could be a potential source of inoculum of *O. haplophylli* once there is a large amount of fields of this vegetable crop in Federal District area. Furthermore, plants of impatiens, balloon plant and calla lily, infected by this fungus were initially collected in a glasshouse with sweet pepper plants presenting powdery mildew symptoms. This promiscuous host range clearly indicates that these ornamental plant species might serve as alternative hosts of both tomato and sweet pepper powdery mildews.

Severe outbreaks of powdery mildew on sweet pepper and tomato caused by *O. haplophylli* were initially restricted to plastic house conditions in Brazil. This powdery mildew disease is now economically important for tomato and sweet pepper under both plastic house and open-field conditions (8, 11, 13). This is the first formal report of a powdery mildew disease on lisianthus, greenhouse calla lily, *I. balsamina*, *A. physocarpa* and nasturtium in Brazil. Powdery mildew caused by *O. haplophylli* was already reported elsewhere for lisianthus (5, 6), greenhouse calla lily (7,

14), *I. balsamina* (9) and nasturtium (1). However, to our knowledge, it is the first report of *O. haplophylli* infecting *A. physocarpa*, extending the host range of this powdery mildew-inducing fungus. These hosts belong to five botanical families, which is in agreement with the current notion that *O. haplophylli* is an atypical powdery mildew since it has a wide host range usually not observed for obligate parasites of the Erysiphaceae family (4, 9, 10, 11).

These powdery mildew diseases might become important on these ornamental crops especially in protected cultivation and under field conditions in hot and dry areas such as those in the Central and Northeast regions of Brazil. The wide host range of *O. haplophylli* could have important epidemiological implications when establishing disease control strategies for these ornamental crops.

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